

## Patent Claims

1. A method for treatment of liquid media, which includes adsorption of impurities contained in a liquid medium by a sorbent, separation and removal of impurities adsorbed, is distinguished by the fact that the impurities are oxidized by mixing the liquid medium with an oxidizing agent using the particulate catalyst impregnated sorbent, the oxides of impurities are adsorbed while separation and removal of the latter is executed by the washing the particulate catalyst impregnated sorbent with a polar solvent, and regeneration of the sorbent is carried out with heat and/or by the blowing through a hot gas.

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2. The method of claim 1, wherein a liquid medium is preliminary fractionated with the fractions having different boiling points and concentration of impurities with the subsequent separate treatment of the fractions.

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3. The method of ~~claims 2 or 3~~, wherein the treated medium is subjected to additional single or multiple purification.

### claim 2

4. The method ~~with respect to any of claims 1-3~~, wherein the oxides of impurities are separated by the distillation of a solvent.

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### of claim 1

5. The method ~~with respect to any of claims 1-4~~, wherein the host liquid media is water.

### of claim 1

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6. The method ~~with respect to any of claims 1-4~~, wherein the host liquid media is hydrocarbon.

### of claim 1

7. The method ~~with respect to any of claims 1-4~~, wherein the host liquid media is other polar aqueous liquids.

of claim 1

8. The method ~~with respect to any of claims 1-4~~, wherein the host liquid media is a hydrocarbon by-product.

of claim 1

5 9. The method ~~with respect to any of claims 1-4~~, wherein the host liquid media is other carbonaceous liquids.

of claim 1

10. The method ~~with respect to any of claims 1-5~~, wherein the impurities being removed are hydrocarbons.

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11. The method of claim 10, wherein the said hydrocarbon is selected from the group as follows: black oil, fuel oil, machine oil, crude oil, mazoot, coke distillate, naphtha, kerosene, diesel, benzene, toluene and gasoline.

claim 1

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12. The method of ~~claims 1 or 5~~, wherein the impurities being removed are metals.

of claim 1

13. The method ~~with respect to claims 1 or 5~~, wherein the impurities being removed are other nonmetallic solids.

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of claim 6

14. The method ~~with respect to claims 6 or 8~~, wherein the host liquid media is selected from the group as follows: cracked gasoline, diesel fuels, kerosene, vacuum distillates, fuel oils, light gas oil, crude oil, heavy gas oil, vacuum gas oil, PCC light cycle oil, coker gas oil, mazoot and naphtha.

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of claim 1

15. The method of ~~claims 1 or 6~~, wherein the impurities being removed are sulfur containing compounds.

claim 1

16. The method of ~~claims 1 or 6~~, wherein the impurities being removed are metals.

claim 1

5 17. The method of ~~claims 1 or 6~~, wherein the impurities being removed are nitrogen compounds, aromatics and poly nuclear aromatics.

10 18. The method of claim 15, wherein the sulfur compounds comprise of at least one of the following elements: thiophene, mercaptan, benzothiophene, dibenzothiophene, naphthobenzothiophene, dinaphthobenzothiophene, and related higher aromatic thiophenes, and the alkyl and aromatic homologues of these compounds.

19. The method of claim 9, wherein the host liquid media is a liquid coal.

15 20. The method of claim 1, wherein oxidizing of impurities is performed using air as an oxidant.

21. The method of claim 1, wherein oxidizing of impurities is performed using oxygen as an oxidant.

20 22. The method of claim 1, wherein oxidizing of impurities is performed using ozone as an oxidant.

23. The method of claim 1, wherein oxidizing of impurities is performed using peroxide as an oxidant.

25 24. The method of claim 1, wherein oxidizing of impurities is performed in the presence of a particulate catalyst impregnated sorbent.

of claim 1

25. The method ~~with respect to any of claims 1, 20, 21, 22, 23~~, wherein providing an oxidizing gas is performed by forming the oxidizing gas into micron size bubbles.

5 26. The method of claim 24, wherein the particulate catalyst impregnated sorbent is comprised of a metal, alkali, or alkali earth metal, metal oxide, a bimetallic combination (combination of metals), and the catalyst impregnated into a carbon particulate, is silica, or an alumina, a zeolite, a perlite form, or any other structurally sound porous sorbent.

10 27. The method of claim 24, wherein the particulate catalyst impregnated sorbent comprising of the catalyst metals selected from the following group: copper, zinc, silver, nickel, cobalt, iron, manganese, molybdenum, vanadium, tungsten, antimony and tin.

15 28. The method ~~with respect to any of claims 26, 27~~, wherein the particulate catalyst impregnated sorbent includes the catalyst component comprising a bimetallic catalyst component, which in its turn should comprise a ratio of the two metals forming such a component in the range of from about 10:1 to about 1:10.

20 29. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is silver.

25 30. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is copper.

31. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is a mixture of silver and copper.

32. The method of claim 31, wherein in accordance with the catalyst bimetallic composition the catalyst component is a bimetallic catalyst component comprising silver and copper in a weight ratio of about 1:1.

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33. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is cobalt.

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34. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is nickel.

35. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is a mixture of nickel and cobalt.

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36. The method of claim 35, wherein in accordance with the catalyst bimetallic composition the catalyst component is a bimetallic catalyst component comprising nickel and cobalt in a weight ratio of about 1:1.

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37. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is zinc.

38. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is tin.

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39. The method of claim 26, wherein in the particulate catalyst impregnated sorbent the catalyst metal is a mixture of zinc and tin.

40. The method of claim 39, wherein in accordance with the catalyst bimetallic composition the catalyst component is a bimetallic catalyst component comprising zinc and tin in a weight ratio of about 2:1.

of claim 26

5 41. The method ~~with respect to claims 26 or 27~~, wherein the particulate catalyst impregnated sorbent comprises the reduced-valence catalyst metal components generally in the range of from about 15 to 40 weight percent of the total weight of the sorbent composition.

10 42. The method of claim 26, wherein the particulate catalyst impregnated sorbent comprises the alkali or alkali earth metals selected from the following group: sodium, potassium, calcium and magnesium.

15 43. The method of claim 26, wherein the sorbent porous structure of the particulate catalyst impregnated sorbent is carbon.

claim 24

20 44. The method of ~~claims 24 or 43~~, wherein the reaction of the carbon with the metal compound is preferably performed in the absence of air while the supporting carbon is in suspension in such a solvent, in which the metal compound is soluble.

45. The method of claim 26, wherein the sorbent porous structure of the particulate catalyst impregnated sorbent is a zeolite.

25 46. The method of claim 45, wherein it is preferred to use such zeolites as the faujasites, particularly zeolite Y and zeolite X, those, having a pore size greater than 10 angstrom in diameter.

47. The method of claim 46, wherein the ion exchange of catalyst ions in the faujasite structure is considered to be acceptable if it is in the range of about 50-75%.

5 48. The method of claim 26, wherein the sorbent porous structure of the particulate catalyst impregnated sorbent is a perlite form.

49. The method of claim 48, wherein the perlite is present in the sorbent support composition in an amount of from 15 to 30 weight percent.

10 50. The method of claim 1, wherein the solvent is a polar organic and/or inorganic solvent which include aromatics, halogenated aromatics, organo-chlorinated compounds, ketones and alcohols.

15 51. The method of claim 50, wherein the polar organic solvent is toluene.

52. The method of claim 50, wherein the polar organic solvent is acetone.

53. The method of claim 50, wherein the polar organic solvent is methanol.

20 54. The method of claim 50, wherein the polar organic solvent is ethanol.

55. The method of claim 50, wherein the polar inorganic solvent is dichloromethane.

25 56. The method of claim 50, wherein the polar inorganic solvent is dichloroethane.

57. The method of claim 50, wherein the polar inorganic solvent is dichlorobenzene.

58. The method of claim 1, wherein the polar solvent is a combination of solvents as follows, including aromatics, halogenated aromatic, organo-chlorinated compounds, ketones and alcohols.

10 59. The method of claim 58, wherein the combinations of polar solvents are selected from the list as follows: toluene, dichlorobenzene, dichloromethane, dichloroethane, cyclopentane, acetone, ethanol and methanol.

15 60. The method of claim 1, wherein for drying the particulate catalyst impregnated sorbent is heated up to the temperatures from 15° C to 150° C, dependent upon the vapor rate of the polar solvent used to wash the sorbent.

61. The method of claim 60, wherein the blowing through the hot gas is used in addition to the heat.

Respectfully submitted

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